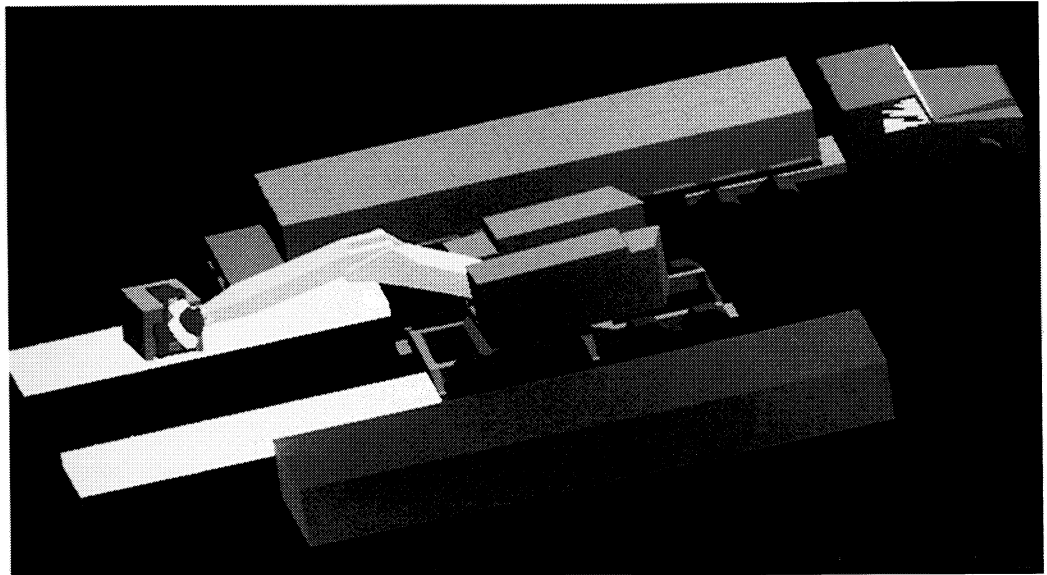


Computer Aided Design (CAD) of products, such as buildings, aircraft, ships and autos, has long been established practice in industry. An advanced step in the CAD process is use of computers not only to create mathematical models of the design but also to predict how the design will perform in actual service. This is much more difficult than it sounds, because all the situations and problems that the product will face in service life must be reduced to mathematics so the computer can "visualize" what would happen under a variety of circumstances.

Martin Marietta Aero & Naval Systems, Baltimore, Maryland has advanced the CAD art to a very high level at its Robotics Laboratory, which designs, analyzes and simulates robot manipulators. One of the company's major projects is construction of a huge Field Material Handling Robot, or FMR (model shown), for the Army's Human Engineering Laboratory.

Design of the FMR, intended to move heavy and



dangerous material such as ammunition, was a triumph of CAD engineering. Separate computer problems modeled the robot's kinematics and dynamics, yielding such parameters as the strength of materials required for each component, the length of the arms and their degree of freedom, and the power of the hydraulic system needed. The Robotics Laboratory went a step further and added data enabling computer simulation and animation of the robot's total operational capability under various unloading and loading conditions.

All these different programs had to be patched together into one integrated program. Rather than develop new integrating software from scratch, the Robotics Laboratory opted to

use a NASA computer program known as IAC, for Integrated Analysis Capability Engineering Database. Originally developed by Goddard Space Flight Center, IAC is a modular software package containing a series of technical modules that can stand alone or be integrated with data from sensors or other software tools. The user can define groups of data and the relationships among them.

In the case of the FMR project, the Robotics Laboratory was able to take data from 15 major software

packages and reformat that data for viewing in different ways to make the program "transparent" to the user. This flexibility greatly facilitated construction of the FMR prototype and contributed substantially to reducing the cost of the project.

IAC was supplied to Martin Marietta Aero & Naval Systems by NASA's Computer Software Management and Information Center (COSMIC)[®]. Located at the University of Georgia, COSMIC makes available to industrial and other organizations government-developed computer programs that have secondary applicability (see page 140). ▲

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